MULTIMEDIA **UNIVERSITY**

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FINAL EXAMINATION

TRIMESTER 2, 2018/2019

EEL3156 – RENEWABLE ENERGY TECHNOLOGY
(LE)

6TH MARCH 2019
9:00am–11:00am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages with 5 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) State the control options available for renewable energy in electricity supply and explain briefly how renewable energy may increase a nation security.   [6 marks]

(b) Sketch a block diagram to show each relation of the finite energy in contributing to high density population.   [6 marks]

(c) The flow rate of a waterfall with 10 meter vertical fall is measured using basic method with a barrel of 180 liter. The results obtained are recorded in table below:

Table Q1

Test #	1	2	3
Time taken (s)	3.8	3.4	3.6

Suggest a suitable hydro plant type can be setup in that waterfall.   [8 marks]

Question 2

(a) Briefly explain three classes of a wind turbine electricity system.   [6 marks]

(b) A wind farm to be setup in an area with 60 propeller turbines. Each turbine blade has a length of 6 m. The measurement of air density and the wind speed for a period of a day are given in Table Q2.

Table Q2

Period of the day	ρ (kgm^{-3})	u_o (ms^{-1})
Morning	1.4	7
Noon	1.2	8
Evening	1.0	9
Night	1.6	6

If the interference factor is 0.08, find
(i) the period of the day for the maximum power in the wind,   [10 marks]
(ii) the total maximum power can be extracted from the wind farm.   [4 marks]

Continued ...

Question 3

(a) Figure Q3 shows a solar water heater system with the plate temperature of $40°C$. The flat plate solar collector has a loss resistance $R_L = 0.15 \text{ m}^2\text{kW}^{-1}$ and 60% plate transfer efficiency. The glass cover has transmittance $\tau = 0.9$ and the absorptance of the plate $\alpha = 0.8$. The ambient temperature is $25°C$ and the irradiance in the plane of the collector $G = 715 \text{ Wm}^{-2}$.

(i) Name all the components A to D in the figure.   [4 marks]

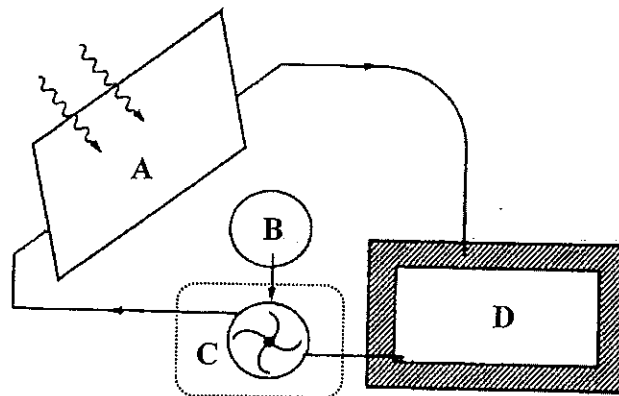(ii) Find the size of component A in order to achieve 85% efficiency.   [10 marks]

Figure Q3

(b) Define the photovoltaic (PV) and photovoltaic cells. Draw the equivalent circuit of a solar cell.   [6 marks]

Continued ...

Question 4

(a) Give three classifications of biomass energy and one general type of its process for each classification. [6 marks]

(b) Bioenergy may assume the form of solid, liquid or gas. Compare solid biomass with biogas biofuel. [7 marks]

(c) A hot dry rock granite depth of 6 km with geothermal temperature gradient at $40°C \, km^{-1}$ was measured. The minimum useful temperature is 120 K above the surface temperature T_0, rock density of $2900 \, kg \, m^{-3}$ and rock heat capacity is $840 \, J \, kg^{-1}K^{-1}$. Calculate the useful heat content per square kilometer. [7 marks]

Question 5

(a) What is pumped storage in hydro plant and explain its working principle. [8 marks]

(b) State the main challenges to integrate power from the wind with grid connection and suggest one solution for each challenge. [6 marks]

(c) List available methods of energy storage employed in renewable energy system and give one example for each method. [6 marks]

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